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STRUCTURAL GENETIC-MORPHOLOGICAL SYNTHESIS OF KINEMATICS OF THE LONGITUDINAL SHARPENING

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ABSTRACT

In the article new conceptual approach of presentation of kreativnogo thought is offered for further realization in the intelligence systems with the use of systematization of Flinna and new look to the financial point, as carrier of genetic data at the synthesis of the difficult developing anthropogenic systems. New approach of design with writing of structural genetic formulas is evidently illustrated on the example of structural synthesis of kinematics of the longitudinal sharpening communicating chisels and it can be widespread at the use of different instruments.

1. NTRODUCTION

The movements imparted to the tool (T) and parts (D) provide the shaping in the machine and can be expressed by principal kinematic cutting schemes [3, 4, 6, 11, 12, 14], in accordance with which the cutting elements T move relative to the cutting surfaces processed by the trajectory of the relative labor movement with speeds, predefined relations: tool (T) - part (D). The kinematics of cutting are presented as a combination of two elementary movements: translational (straight) and rotational [4, 5]. In this case, translational and rotational movements can be both the main movement and the feed movement, which is incorporated in various classifications of principal kinematic cutting schemes for processing simple and complex parts; it is used in the analysis of formative movements in machine tools [13], design of cutting tools [10, 14, 15], as well as the description of the machine arrangements [17].

In the works of the Kiev scientific school of Prof. Kuznetsov Yu.N. [1,7-9-9] for the first time it was proposed to use the material point by analogy with an electric charge in an open by Prof. Shinkarenko V.F. Periodic table of the primary sources of the electromagnetic field [16].

Today the development in the field of technical systems design has started gravitating towards the gradual transition to structural-system studies [2, 16]. Based on the progress in biology, cybernetics, information technology, artificial neural networks, psychology, socionics and other new interdisciplinary research areas, that studies the heredity laws and structural variabikity of evolving natural and anthropogenic systems [2].

2. THE MAIN PART

Proposed by Prof. Granovsky G.I. digital coding of kinematic cutting schemes in the form of three figures [4], the first of which indicates belonging to a group, and the next two numbers - to the next serial number occupied by the scheme in the group do not cover all conceivable and inconceivable options. Consider the easy examples of a significant increase in kinematic schema options a for cutting surfaces of revolution with a longitudinal feed in accordance with code No. 401 (fig.1).

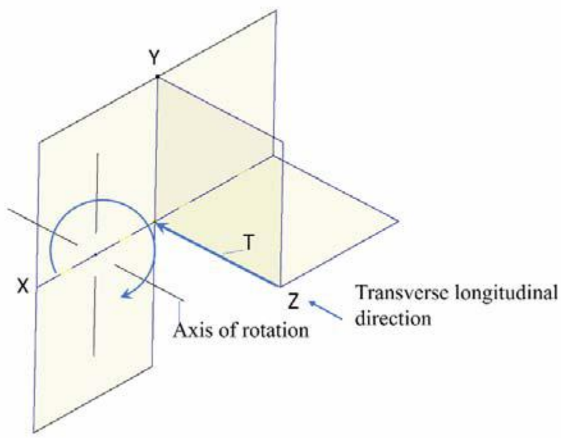

Fig. 1. Kinematic cutting scheme to Granovsky G.I. (code 401), corresponding to turning with cutting tools (helical path relative to movement)

By analogy with Flynn classification [8] all kinds of information transfer by mass points and their interactions can be represented by four classes (Fig. 2).

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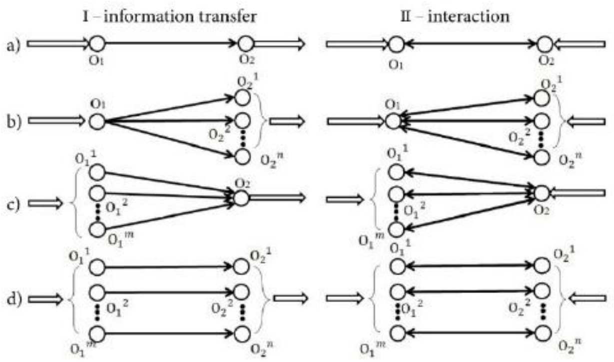


Fig. 2. Ways of information transfer and mass point interaction according to Flynn classification: a – single input, single output; b – single input, multiple outputs; c – multiple inputs, single output; d – multiple inputs, multiple outputs

By modeling an object like "process" - "cutting", an abstract image in the form of interaction of material points [1, 7, 8] for the subsequent synthesis of kinematic cutting patterns contains genetic information about three indicators: the main movement - cutting speed expressed through the rotation frequency ω_Z; the speed of relative movement, expressed through the flow of S_z; of varying size - the radius of the cylindrical surface R_x, on which the O_1 and O_2 points interact (Fig. 3).

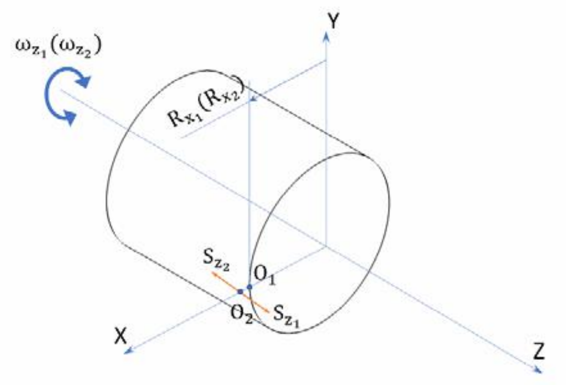


Fig. 3. Fragment of the kinematic cutting scheme for the synthesis of longitudinal turning options (threading) using the genetic-morphological approach (version 1 „one detail – one cutter")

Consider the structural genetic formulas of some variants of kinematic cutting schemes with explanations:

Version 1 (ω_{z_1}, 0, Rx1) – (0, S_{z_2}, Rx2) - longitudinal turning of a rotating part (p.O1) by a progressively moving non-rotating cutter parallel to the Z axis (p.O2).

Version 3 (0, 0, Rx1) – (ω_{z_2}, S_{z_2}, Rx2) - longitudinal turning of a non-rotating part (p.O1) by progressively moving parallel to the Z axis by a rotating (flying) cutter (p.O2).

Version 3 (ω_{z_1}, S_{z_1}, Rx1) – (0, 0, Rx2) - longitudinal turning of a rotating and progressively moving part (p.O1) relative to a fixed tool (p.O2).

Version 4 (0, S_{z_1}, Rx1) –(ω_{z_2}, S_{z_2}, Rx2) - longitudinal turning of a non-rotating progressively moving part (p.O1) along the Z axis relative to a rotating (volatile) cutter (p.O2).

Version 5 (ω_{z_1}, 0, Rx1) – (ω_{z_2}, S_{z_2}, Rx2) - vortex longitudinal turning of a rotating part (p.O1) by progressively moving along the Z axis by a rotating (volatile) chisel (p.O2).

Version 6 (ω_{z_1}, Sz1, Rx1) – (0, S_{z_2}, Rx2) - longitudinal turning of a rotating and progressively moving part (p. O1) with a counter-translational movement of the tool (p. O2).

Version 7 (ω_{z_1}, Sz1, Rx1) – (ω_{z_2}, S_{z_2}, Rx2) - vortex longitudinal turning of a rotating and translationally moving part (p. O1) with a counter-translational movement of a rotating cutter (p. O2).

In accordance with fig.2, for case II - interaction, examples are given of the implementation of Flynn's systematics (Fig. 4) with variants of records of structural genetic formulas:

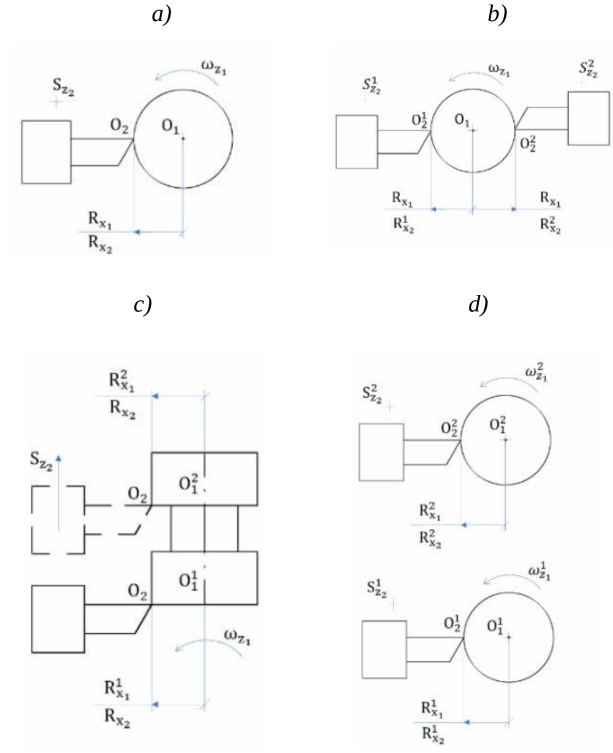


Fig. 4. An example of the implementation of four kinematic diagrams of longitudinal turning according to Flynn systematics (see Fig. 2): a) one detail - one cutter; b) one detail - two cutters; c) two parts - one cutter; d) two parts - two incisors (twins vertically)

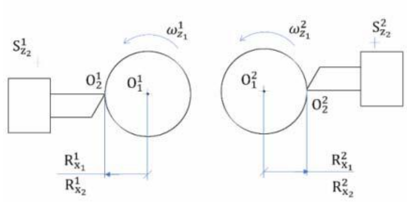
a) $(\omega_{z_1}, 0, R_{x1}) - (0, S_{z_2}, R_{x2})$

b) $(\omega_{z_1}, 0, R_{x1})$ $\begin{matrix} (0, S^1_{z_2}, R^1_{x_2}) \\ (0, S^2_{z_2}, R^2_{x_2}) \end{matrix}$ or $(\omega_{z_1}, 0, R_{x1}) - (0, S_{z_2}, R_{x2})_2$

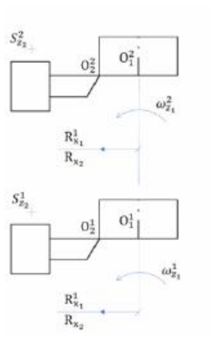
c) $\begin{matrix} (\omega_{z_1}, 0, R^1_{x_2}) \\ (\omega_{z_1}, 0, R^2_{x_2}) \end{matrix}$ $(0, S_{z_2}, R_{x2})$ or $(\omega_{z_1}, 0, R_{x1})_2 - (0, S_{z_2}, R_{x2})$

The last option (Fig. 4, d) can be implemented in different ways in the layout of machines (Fig. 5) in accordance with the theory of composetics [17].

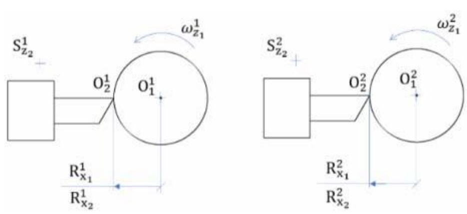
a)



b)



c)



d)

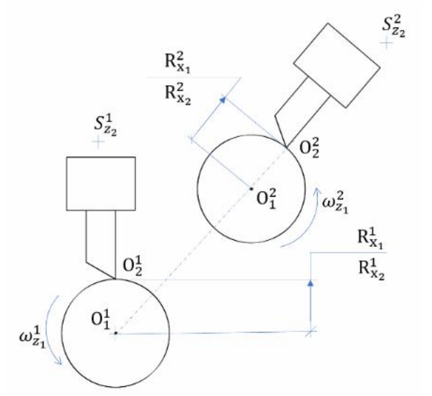


Fig. 5. Options for the implementation of the kinematic scheme of longitudinal turning in addition to Fig. 4,2: a - mirror; b - along one axis of rotation; c - twins horizontally; d - arbitrary orientation

3. CONCLUSION

In contrast to the well-known approaches of describing, modeling and synthesizing kinematic cutting schemes and the principles of shaping, a new genetic and morphological approach has been proposed, creating real prerequisites for using artificial intelligence systems in the search for innovative technical solutions and genetic foresight in the field of mechanical engineering and, in particular, in machine tool industry.

The effectiveness of the new approach is illustrated with examples of multivariate longitudinal turning, which determined the relevance of exploratory research and the need to develop and implement the proposed concept.

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